EXPERIMENTS IN FORCING GLADIOLI

By F. F. WEINARD
and S. W. DECKER

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CONTENTS

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Experiments in Forcing Gladioli

By F. F. Weinard, Associate Chief in Floricultural Physiology, and
S. W. Decker, Associate in Floriculture

GLADIOLI are being grown under glass for cut-flowers in increasing numbers. Generally the corms are planted in January or early in February and flower in May. Altho there is a demand for the flowers earlier in the season, early planting has not proved profitable on a commercial scale because of the large proportion of "blind" plants on which flowers fail to develop. Apparently the corms must undergo a certain period of dormancy, or rest, before they can be grown successfully with ordinary methods. Aside from the influence of variety and time of planting, growers state that size, age, and previous use of the corms, the temperature of storage, the temperature of the house, and the method of watering, all have considerable to do with the results obtained.

Experiments were conducted at the Illinois Experiment Station over several seasons to determine the importance of certain of these factors, including previous use and size of corms, temperature of storage, and time of planting. Chemicals and artificial light were tried for the purpose of breaking the rest period and for stimulating growth.

In all these tests the corms were planted at a uniform depth of 2 inches, 6 inches apart each way, in benches 6 inches deep. The soil was brown silt loam containing about one-fifth manure and a little steamed bone meal. Temperatures maintained were 52° F. night and 58° to 68° F. in so far as possible during the day.

DISCUSSION OF RESULTS

Comparison of Varieties

No attempt was made to test the forcing qualities of a comprehensive list of varieties. In most of the plantings Chicago White, Halley, Mrs. Francis King, and Mrs. Frank Pendleton, varieties well adapted to forcing, were used. Some results with certain newer varieties are given for comparison (Table 1).

In this test Flanders, Seafoam, and Virginal were especially good, while Elsie McCormick, Lansing, L. W. Wheeler, and Princess Elizabeth showed structural defects or appeared otherwise undesirable for

TABLE 1.—FLOWER PRODUCTION OF SOME VARIETIES OF GLADIOLI GROWN UNDER GLASS

Variety	Corms planted				Days to sprout	Days to flower[2]	Average number of buds a spike	Average stem length
	Number planted[1]	Number sprouting	Percentage flowering	Spikes cut per 100 corms				
								inches
Elizabeth Tabor	96	95	97	111	15	88	12	41
Elsie McCormick	96	93	90	122	16	98	10	34
Flanders	96	96	97	206	14	87	13	43
Halley	200	200	93	134	16	91	9	45
Ionia	96	95	85	100	15	96	13	43
Lansing	96	96	64	81	14	95	9	40
Lavender No. 698 (Vaughan)	96	95	94	126	15	104	11	47
L. W. Wheeler	96	88	81	108	16	98	11	40
Mrs. Frank Pendleton	200	198	92	100	14	100	11	52
Orange Queen	200	191	96	172	25	100	13	39
Pink No. 829 (Vaughan)	96	96	86	168	14	100	10	43
Pinkprim	96	95	94	211	22	100	11	37
Princess Elizabeth	96	96	84	117	13	92	11	46
Seafoam	96	83	98	201	24	104	10	41
Virginal	96	95	73	103	13	99	15	36
Yellow No. 1176 (Vaughan)	96	94	83	132	23	105	10	41

[1]Corms planted February 26 and 28; Seafoam, March 2, 1929. [2]From time of planting.

forcing. The corms planted late in February sprouted in about two weeks and flowered in about a hundred days.

Corms Forced Successfully a Second Time

Flowers from forced corms were cut in May, two good leaves being left on each shoot. On June 15 the plants were lifted, tops and all, and placed in a cool room to dry before being cleaned. These corms were stored in a cool room and planted in the bench the following season on December 12 and 26 and on January 9 and 23. Corms which had not been forced were planted each time for comparison. The averages from all the plantings are shown in Table 2.

The results from corms forced for the second time were in all respects as good as the results from new corms. Under commercial conditions it may or may not be feasible to allow corms to ripen in the bench after forcing.

Flower Production of Corms of Different Sizes

First-size corms (1½ inches and up) are perhaps generally preferred by florists. Oven[14]* found in an experiment in the field that a considerably larger number of flower spikes were produced from 2-inch corms than from corms measuring 1½ inches or less. The larger corms bloomed earlier and had a longer season of flowering.

The figures shown in Table 2 are of interest in this connection. Corms being forced the second time in 1925-26 were graded into 2-inch and 1½-inch sizes. As the time of planting did not seem to give important variations in results, only the averages for all plantings are shown. There were no differences in the time it took the different sizes to sprout or to flower, but higher percentages of the larger corms flowered, and likewise the total flower production of the larger corms was larger with three varieties. In the case of Halley the difference amounted to 25 percent. On the other hand, Mrs. Frank Pendleton showed no increase in flower production from the larger corms.

In 1928 corms from No. 3 stock in the field were graded into 1¼-inch, 1½-inch, and 2-inch sizes and planted in the bench on February 11 (Table 3). In this test the percentage of corms that flowered was in inverse ratio to the size of the corms. There appeared to be no consistent differences, however, in the total number of spikes cut from the different sizes.

This experiment needs repetition with larger numbers of corms before definite conclusions can be drawn.

TABLE 2.—FLOWER PRODUCTION OF CORMS FORCED THE SECOND TIME

Variety	Corms planted						Days to sprout	Days to flower	Average number of buds a spike	Average stem length
	Type	Size	Number planted[1]	Number sprouting	Percentage flowering	Spikes cut per 100 corms				
		inches								inches
Chicago White	New	2	128	122	60	68	29	133	11	38
	Old	2	64	63	75	87	20	130	11	39
	Old	1½	64	64	58	61	21	132	12	40
Halley	New	2	128	128	87	101	26	129	9	40
	Old	2	64	63	88	100	21	132	9	40
	Old	1½	64	64	63	80	21	132	10	41
Mrs. Francis King	New	2	128	128	80	99	23	132	9	42
	Old	2	64	64	78	92	23	142	9	43
	Old	1½	64	64	72	77	26	145	9	43
Mrs. Frank Pendleton	New	2	128	115	90	92	30	136	10	43
	Old	2	64	62	88	91	30	139	9	44
	Old	1½	64	63	86	91	32	140	8	43

[1]Total of plantings made December 12 and 26, 1925; January 9 and 23, 1926.

TABLE 3.—FLOWER PRODUCTION OF CORMS OF DIFFERENT SIZES

Variety	Corms planted					Days to sprout	Days to flower	Average number of buds a spike	Average stem length
	Size	Number planted[1]	Number sprouting	Percentage flowering	Spikes cut per 100 corms				
	inches								inches
E. J. Shaylor	2	24	24	67	96	17	98	11	35
	1½	24	23	79	92	19	100	11	36
	1¼	24	24	96	100	20	101	10	33
Halley	2	24	24	71	96	14	95	11	41
	1½	24	24	75	75	15	95	10	38
	1¼	24	24	92	96	15	92	11	38

[1]Planted February 11, 1928.

Effect of Storage Temperature

Boswell,[1]* working with onions, found that the development of flower primordia was hindered at low temperatures. He concluded that "bulbs which are to be planted for seed production should be stored at a temperature which will reduce to a minimum the losses from growth and decay during storage and still have no injurious effect upon floral development. This happy medium perhaps lies somewhere between 40° and 45° F."

Floyd[7]* reported an experiment in which gladiolus corms were stored in an open shed in Florida and also placed for periods as long as four months in cold storage at 32° to 35° F. and at 42° to 45° F. before planting in the field. Corms stored at 32° to 35° F. came up and also bloomed about a week later than did corms stored at 42° to 45° F. The length of time the corms were in cold storage seemed to make little difference in the results. There was no marked difference in results with corms stored at 42° to 45° F. as compared with corms stored in the open air.

Loomis[11]* showed that the rest period of potatoes was shortened by storage at a temperature of about 86° F. in comparison with storage at lower temperatures. Also, relatively high soil temperatures seemed to aid the germination of partially dormant tubers.

Loomis and Evans[12]* state that high storage temperatures and high soil temperatures were very effective likewise in forcing gladioli. Arlon, Halley, and Marshal Foch were used, and it is suggested that temperatures ranging from about 77° F. for four weeks to 102° F. for one week should prove approximately equally effective.

At the University of Illinois test plantings were made under glass for several seasons to determine the effects, if any, of storage temperature on subsequent forcing qualities of gladiolus corms. In 1922-23 plantings were made from corms held in storage at 38° F. Corms planted at the same time for comparison were stored in the potting room, where the temperature was 70° to 80° F. On January 10, after five weeks in cold storage, the corms were removed to the potting room. Plantings were made on January 10, 17, 24, and 31. In a similar experiment in 1923-24 half the corms were stored for four weeks at 38° F. and the remainder in a cool basement room where the temperature was about 60° F. The corms were removed from cold storage on December 4 and plantings made on December 4 and 18. In 1924-25 corms were in cold storage as long as thirteen weeks, being removed as needed for planting on December 9 and 23, January 6 and 20, and February 6. The controls were stored in the potting room.

TABLE 4.—EFFECT OF STORAGE TEMPERATURE ON FLOWER PRODUCTION OF GLADIOLUS CORMS

Variety	Storage	Corms planted				Days to sprout	Days to flower
	Temperature	Number planted	Number sprouting	Percentage flowering	Spikes cut per 100 corms		
Stored 5 weeks; planted January 10-31, 1923							
America	Warm	32	32	41	47	18	123
	Cold	32	32	69	91	28	132
Chicago White	Warm	32	32	76	84	22	120
	Cold	32	32	87	119	28	123
Mrs. Frank Pendleton	Warm	32	32	97	112	17	115
	Cold	32	32	88	109	29	122
Stored 4 weeks; planted December 4-18, 1923							
Chicago White	Cool	32	32	0	0	31	...
	Cold	32	32	0	0	39	...
Halley	Cool	32	32	47	50	25	131
	Cold	32	32	59	81	35	135
Mrs. Frank Pendleton	Cool	32	31	94	97	102	153
	Cold	32	32	84	91	95	146
Stored 9 to 13 weeks; planted January 6–February 6, 1925							
Chicago White	Warm	96	95	90	106	27	106
	Cold	96	96	68	97	32	107
Halley	Warm	96	96	84	97	15	90
	Cold	96	96	85	101	33	103
Mrs. Francis King	Warm	96	90	92	130	20	108
	Cold	96	95	88	123	32	120
Mrs. Frank Pendleton	Warm	96	95	92	100	20	104
	Cold	96	96	96	121	33	114

As shown in Table 4, corms from warm storage sprouted 5 to 18 days sooner than did those from cold storage. Tho greater differences were obtained in certain instances, this result did not vary with the time of planting. The time of flowering was affected, as was the time to sprout, by storage temperature, but the differences were as a rule considerably smaller. The results on the number of corms flowering and number of spikes cut were somewhat inconsistent, with the advantage, if any, in favor of the cold-storage corms.

A storage temperature of 40° to 45° F. is commonly recommended for gladiolus corms. The results of these tests indicate the desirability of cool temperatures. Flower development was not markedly delayed when corms were held at 38° F. The corms do not shrivel under prolonged storage when temperatures are low, and a minimum of "blind" shoots is obtained. At the same time storage rots are held more or less in check. No doubt the time to flowering may be shortened by exposure to higher temperatures for a time before planting. This treatment can be left, however, for the grower who forces the corms.

Prolonged storage at either temperature extreme is not to be recommended, and high temperatures even for short periods should be used with caution.

Varying Time of Planting

The effects of varying the time of planting in forcing gladiolus corms may be seen in Tables 5 to 8. The time to sprout was progressively shortened from about 40 days in the case of corms planted early

TABLE 5.—TIME OF PLANTING AS AFFECTING FLOWER PRODUCTION OF GLADIOLI UNDER GLASS, 1922-23

Variety	Dates of planting	Corms planted				Days to sprout	Days to flower
		Number planted	Number sprouting	Percentage flowering	Spikes cut per 100 corms		
America	Dec. 13	16	16	0	0	36	...
	Dec. 20	24	24	8	8	32	150
	Dec. 27	32	32	28	28	28	145
	Jan. 3	40	40	30	30	28	150
	Jan. 10	80	80	37	47	30	135
	Jan. 17	72	72	55	71	24	131
	Jan. 24	64	64	49	78	20	121
	Jan. 31	56	55	62	82	19	119
Chicago White	Dec. 13	16	16	62	69	38	145
	Dec. 20	24	24	67	79	36	144
	Dec. 27	32	32	75	109	34	138
	Jan. 3	40	40	72	92	32	134
	Jan. 10	80	80	78	107	33	129
	Jan. 17	72	72	89	126	27	123
	Jan. 24	64	64	95	119	22	118
	Jan. 31	56	56	96	111	19	114
Mrs. Frank Pendleton	Dec. 13	16	16	94	138	42	152
	Dec. 20	24	24	100	112	42	149
	Dec. 27	32	32	94	106	35	140
	Jan. 3	40	40	97	110	31	136
	Jan. 10	80	80	96	111	31	129
	Jan. 17	72	72	94	107	24	124
	Jan. 24	64	64	95	108	19	118
	Jan. 31	56	56	96	111	15	111

TABLE 6.—TIME OF PLANTING AS AFFECTING FLOWER PRODUCTION OF GLADIOLI UNDER GLASS, 1923

Variety	Dates of planting	Corms planted				Days to sprout	Days to flower
		Number planted	Number sprouting	Percentage flowering	Spikes cut per 100 corms		
Chicago White	Dec. 4	80	80	0	0	39	...
	Dec. 18	80	80	4	5	30	143
	Dec. 26	32	32	31	34	30	145
Halley	Dec. 4	80	80	16	17	35	138
	Dec. 18	80	80	77	95	28	129
	Dec. 26	52	52	84	92	25	126
Mrs. Frank Pendleton	Dec. 4	80	79	91	106	55	155
	Dec. 18	80	80	96	105	41	144
	Dec. 26	32	32	100	112	35	138

TABLE 7.—TIME OF PLANTING AS AFFECTING FLOWER PRODUCTION OF GLADIOLI UNDER GLASS, 1924-25

Variety	Dates of planting	Corms planted: Number planted	Number sprouting	Percentage flowering	Spikes cut per 100 corms	Days to sprout	Days to flower
Chicago White..........	Dec. 9	64	64	22	26	38	136
	Dec. 23	64	63	58	73	38	127
	Jan. 6	64	64	62	80	32	119
	Jan. 20	64	64	89	106	30	107
	Feb. 6	64	64	84	119	27	93
Halley.................	Dec. 9	64	64	51	58	·31	131
	Dec. 23	64	64	70	84	30	122
	Jan. 6	64	63	75	84	27	113
	Jan. 20	64	64	89	103	24	103
	Feb. 6	64	64	92	109	22	91
Mrs. Francis King......	Dec. 9	64	62	72	96	36	142
	Dec. 23	64	61	80	111	31	132
	Jan. 6	64	64	84	113	28	126
	Jan. 20	64	63	94	136	25	114
	Feb. 6	64	63	91	131	25	103
Mrs. Frank Pendleton...	Dec. 9	64	64	95	105	46	144
	Dec. 23	64	64	84	108	38	128
	Jan. 6	64	64	94	106	28	122
	Jan. 20	64	64	91	116	26	110
	Feb. 6	64	63	97	109	24	95

in December to about 20 days when the corms were planted the last of January. The time to flower was similarly shortened in the same period from about 140 days to about 120 days.

About 30 percent or less of corms planted before the middle of December produced flowers. The percentages flowering in the early and late January plantings were about 70 percent and 80 percent respectively. Counting all spikes cut from the same plantings, the percentages were about 35, 85, and 105 percent respectively. Results varied to a considerable extent with the variety. Mrs. Frank Pendleton, for example, gave comparatively good results even in early December plantings. With Halley and other varieties much better yields were obtained from plantings made along in January.

Chemical Treatments of Doubtful Value

Various chemicals, including ethylene, ethylene chlorid and ether, have been used for breaking the rest period of tubers, bulbs, and the like. Out of 224 different chemicals tried with potato tubers, Denny[2, 3, 4*] obtained especially marked results with ethylene chlorohydrin, sodium and potassium thiocyanate, ethylene dichlorid, and several other materials. Thiourea forced the development of more than one sprout per eye and more than one eye on each tuber. Results with ethylene were unsatisfactory.

TABLE 8.—TIME OF PLANTING AS AFFECTING FLOWER PRODUCTION OF GLADIOLI UNDER GLASS, 1925-26

Variety	Dates of planting	Corms planted: Number planted	Corms planted: Number sprouting	Corms planted: Percentage flowering	Corms planted: Spikes cut per 100 corms	Days to sprout	Days to flower	Average number of buds a spike	Average stem length
									inches
Chicago White	Dec. 12	64	64	12	12	26	142	11	40
	Dec. 26	64	64	52	66	26	139	11	38
	Jan. 9	64	64	91	103	23	127	12	40
	Jan. 23	64	58	98	103	25	120	11	38
Halley	Dec. 12	64	64	74	86	29	147	8	38
	Dec. 26	64	63	73	87	22	134	10	42
	Jan. 9	64	64	95	108	18	126	10	40
	Jan. 23	64	64	82	100	19	114	9	40
Mrs. Francis King	Dec. 12	64	64	67	88	29	154	8	43
	Dec. 26	64	64	70	77	25	139	8	44
	Jan. 9	64	64	89	108	20	135	8	42
	Jan. 23	64	64	83	95	20	122	10	42
Mrs. Frank Pendleton	Dec. 12	64	62	81	91	43	155	8	41
	Dec. 26	64	58	65	82	31	141	9	44
	Jan. 9	64	60	91	98	25	129	9	44
	Jan. 23	64	59	95	95	22	121	10	44

Denny[5]* found that cormels of Halley were stimulated into earlier growth by treatment with ethylene chlorohydrin. Haber[8]* states that Paper White narcissus bulbs treated with ethylene or ethylene chlorohydrin bloomed 7 to 9 days earlier than checks. Vacha and Harvey[17]* reported that growth of gladiolus corms was advanced appreciably by treatment with ether, chloroform, ethylene and propylene. Miller[13]* hastened the sprouting of corms with ethylene and acetylene. Pridham[15]* mentioned a similar effect from ethylene. In none of these cases apparently were the corms carried on to the flowering stage.

Laurie[10]* treated corms of five varieties, including Halley and Maiden's Blush, with ethylene and ether. The corms were dug in September and treated before planting in late December. "The treated corms produced flowers from two to four weeks earlier than the untreated corms, and the percentage of flowering was increased 100 to 200 percent." Loomis and Evans[12]* found that vegetative growth of Halley was stimulated by treatments with ethylene chlorohydrin, but that flowering was not greatly ahead of the normal date. Ethylene chlorohydrin was not as effective in forcing as were high temperatures in storage and high soil temperatures after planting. At the Rhode Island Agricultural Experiment Station chemicals used to hasten germination had but little effect.[16]*

In the present experiments corms of Halley and Maiden's Blush were treated with ether, ethylene dichlorid, ethylene hydrochlorid, potassium thiocyanate and thiourea. Most of the treatments were with gas, tho in the case of ethylene hydrochlorid dip was also used. The corms were exposed to the gases at room temperature, in large dessicators with false bottoms, a small piece of cotton containing the chemical being placed on top of the corms.

Ethylene dichlorid was most effective in initiating early growth (Table 9). Results from the other treatments were slight and inconsistent. The concentration and time of treatment with ethylene dichlorid varied from .1 cc. to .4 cc. per liter for 24 hours to .2 cc. per liter for 48 hours. On the whole, the chemical seemed most effective when used at the rate of 1⅓ teaspoonfuls (.2 cc. per liter) to a cubic foot of air space for 24 hours. The treated corms were aired over night before planting.

Treated Halley corms sprouted about 30 to 40 days earlier on the average than the untreated corms, in two seasons' trials. The difference with Maiden's Blush was about seven days. There was little difference in time of flowering the first season, but in the second season the treated corms of Halley flowered about thirty days earlier.

TABLE 9.—EFFECTS OF CHEMICAL TREATMENTS ON GLADIOLI UNDER GLASS

Variety	Treatment	Dates of planting	Corms planted				Days to sprout	Days to flower
			Number planted	Number sprouting	Percentage flowering	Spikes cut per 100 corms		
Halley (1926-27)	None	Oct. 2	32	32	31	40	108	220
	Ethyl. dichlor.	Oct. 2	32	32	3	3	26	226
	None	Nov. 2	16	16	100	106	96	196
	Ethyl. dichlor.	Nov. 2	16	16	69	69	80	189
	None	Dec. 6	32	32	94	106	58	153
	Ethyl. dichlor.	Dec. 6	32	32	34	34	44	160
	None	Jan. 6	24	22	92	96	33	130
	Ethyl. dichlor.	Jan. 6	24	21	88	137	35	130
Halley (1927-28)	None	Nov. 7	32	32	78	84	92	188
	Ethyl. dichlor.	Nov. 7	32	7	0	0	49	...
	None	Nov. 23	32	31	59	66	85	182
	Ethyl. dichlor.	Nov. 23	32	19	3	3	59	154
	None	Dec. 6	32	32	44	47	78	169
	Ethyl. dichlor.	Dec. 6	32	32	62	84	39	143
	None	Dec. 20	32	31	56	62	69	154
	Ethyl. dichlor.	Dec. 20	32	31	78	94	30	134
	None	Jan. 7	32	30	87	97	52	138
	Ethyl. dichlor.	Jan. 7	32	28	37	50	40	124
Maiden's Blush (1926-27)	None	Nov. 2	32	31	87	169	102	194
	Ethyl. dichlor.	Nov. 2	32	30	94	169	105	197
	None	Dec. 6	24	24	87	162	87	175
	Ethyl. dichlor.	Dec. 6	32	31	87	200	64	157
	None	Jan. 6	16	16	100	250	42	132
	Ethyl. dichlor.	Jan. 6	16	16	100	180	45	135

On the other hand, in both seasons the percentage of corms flowering and the total spikes cut were about 40 and 30 percent lower respectively on the treated as compared with the untreated corms. With Maiden's Blush there was little or no difference in results from the treated and untreated corms.

These results show inconsistencies in certain plantings and they are not in entire agreement with other work. There evidently is considerable to be learned in regard to the action of chemicals on corms. Denny[6]* showed, for example, that the temperature at time of treatment is important. Below 68° F. a dipping solution of ethylene chlorohydrin was only partially effective in breaking the rest period of potato tubers, while above 90° F. injury and rotting resulted.

It is probable that variety or condition of the corms may likewise affect the results. In these experiments corms of Arlon treated with ethylene dichlorid and planted on November 2 rotted in the soil, while two other varieties similarly treated were uninjured.

At the present time chemical treatments for gladiolus corms cannot be unreservedly recommended. In the majority of cases in these experiments the percentages of flowers from treated corms were considerably lower than those from untreated corms.

Effect of Artificial Lighting

Corms of Virginia, harvested in California in April and June, 1927, were planted on October 1, half under 500-watt Mazda lamps and the remainder on the opposite bench. The lamps were spaced about 6 feet apart and raised 3 feet above the plants. A muslin curtain was drawn between the two benches at night. The lights were turned on from 5 o'clock in the evening until midnight. In a similar experiment the following season, June-harvested Virginia and Souvenir from California were used. In both experiments the lights were turned on all night, from the time the plants were a few inches high until flowering began. The results are shown in Table 10.

In 1927-28 the time to flower was reduced about ten days by the use of artificial light and the percentages of corms flowering and total flowers produced were more than doubled. In the second season there was no significant difference in the time to flower. Virginia under the lights gave increases of 8 and 12 percent respectively in corms flowering and total spikes cut, while the corresponding increases with Souvenir were 17 and 19 percent. The curtain separating the plantings was not entirely opaque, however, and with overnight illumi-

TABLE 10.—EFFECTS OF ARTIFICIAL LIGHT IN FORCING GLADIOLI

Variety	Treatment	Dates of planting	Corms planted				Days to sprout	Days to flower	Average number of buds a spike	Average stem length
			Number planted	Number sprouted	Percentage flowering	Spikes cut per 100 corms				
										inches
Virginia............	None	Oct. 1	48	48	33	33	8	130	6	35
(1927)	Lights	Oct. 1	48	47	71	83	7	119	7	34
Souvenir...........	None	Sept. 13	48	48	85	94	24	134	7	33
(1928)	Lights	Sept. 13	48	48	100	112	25	133	7	33
Virginia............	None	Sept. 13	48	48	77	87	13	135	7	28
(1928)	Lights	Sept. 13	48	48	83	98	13	133	8	30

TABLE 11.—RESULTS FROM HALLEY CORMS HELD OVER FOR EARLY FORCING THE SECOND SEASON, 1927-28

Treatment	Dates of planting	Corms planted				Days to sprout	Days to flower	Average number of buds a spike	Average stem length
		Number planted	Number sprouting	Percentage flowering	Spikes cut per 100 corms				
									inches
Held over	Aug. 4	80	80	15	15	8	70	6	33
Held over	Sept. 6	96	96	0	0	8	...	..	..
Held over	Oct. 1	96	96	1	1	10	168	7	32
Held over	Nov. 7	48	47	8	8	14	139	6	26
New	Nov. 7	32	32	78	84	92	188	13	44
Held over	Dec. 6	32	32	41	59	17	145	7	30
New	Dec. 6	32	32	44	47	78	169	12	46
Held over	Jan. 7	32	31	69	115	24	112	7	34
New	Jan. 7	32	30	87	97	52	138	11	45

nation the control bench may have received sufficient light to stimulate flowering somewhat, for the yields on the untreated bench seemed unusually high for early planted stock.

Corms Held Over in Storage for Early Forcing

Pridham[15]* states that corms held over the summer in cold storage produced normal plants from fall plantings, and that early California grown bulbs were used with comparable results. Jones[9]* held corms over summer in cold storage and planted them in October. The plants made good growth but gave practically no blooms.

In 1927 Halley corms were planted which had been held over from the previous season in storage at about 50° F. By the planting time the corms were considerably shrunken. Some flowers were obtained from an August planting, but plantings made in September, October, and November were unsuccessful. About 40 percent bloomed when planted in December, and about 70 percent of the January planting bloomed. New corms planted for comparison in November, December, and January flowered from 49 to 26 days later than the corms held over, the time of flowering depending on the time of planting. The new corms, however, flowered more freely than the held-over corms (Table 11).

CONCLUSIONS

1. Young corms 1½ inches and more in diameter (No. 1's) are desirable for forcing purposes. Corms between 1¼ and 1½ inches in diameter (No. 2's) may give as good results as the larger corms tho these experiments were not extensive enough to justify the belief that they would consistently give as good results.

2. Corms which have been properly ripened off after forcing may be forced successfully a second time.

3. Corms from cold storage come into growth somewhat slower than corms kept in a warm place. When held in a warm place the corms may show a greater tendency to produce "blind" shoots, but there seems to be no marked advantage in storing corms at temperatures below 40° F. Storage at temperatures of 40° to 45° F. early in the season, with perhaps 70° F. or higher for a short time previous to planting, is suggested as likely to be most effective in promoting the healthy development of the corms.

4. Flowering of early planted corms may be stimulated by the use of artificial light. This suggests that the short days of winter are responsible for the slow growth and the high percentage of "blind"

shoots normally found in winter plantings. The use of artificial light is not recommended for commercial plantings at present on account of the cost.

5. In plantings made before the first of the year, there will be a relatively large proportion of "blind" shoots, the number depending to a certain extent upon the variety. Under ordinary conditions, early planting of fall-dug corms will not insure flowers either proportionately early or in paying quantities.

6. Corms may be forced into early growth with certain chemicals such as ethylene dichlorid or ethylene chlorohydrin. Such treatments are not yet standardized, however, and may be ineffective or injurious. They are not recommended, therefore, as a regular commercial practice.

7. The holding-over of corms for early planting the following season was not a practical success in these experiments.

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